Title: Ring Around the Classroom

Brief Overview:

In this activity students will use a graphing calculator and statistical concepts to analyze the relationship between holding hands at arm's length and the distance covered. Students will use the equation of the median-median line and the least squares line to make predictions.

Links to Standards:

- **Mathematics as Problem Solving**
  Students will collect, organize, and make inferences about data.

- **Mathematics as Communication**
  Students will discuss the similarities and differences between the median-median line and the least squares line.

- **Mathematics as Reasoning**
  Students will choose the model of best fit and justify their choice.

- **Algebra**
  Students will write equations of lines using slopes**.**

- **Geometry from an Algebraic Perspective**
  Students will use graphing techniques.

- **Statistics**
  Students will use modeling to make predictions.

Grade/Level:

Grades 9-12, Algebra and Statistics

Duration/Length:

This activity will take 2 or 3 class periods**.**

Prerequisite Knowledge:

Students should have working knowledge of the following skills :

- The Cartesian plane
- The TI-82/83 statistical keys
- Linear functions
- Slopes of parallel lines

- Measures of central tendency
- Scatter plots

Objectives:

Students will:

- create a scatter plot from the sample data.
- find the equation of the median-median line.
- construct a median-median line on graph paper.
- write the linear regression equation using a calculator.
- make predictions using regression equations.

Materials/Resources/Printed Materials:

- Graphing calculators
- Measuring tapes or meter sticks

Development/Procedures:

Collecting Data:

- In groups of 2-3, students should measure their arm spans with a measuring tape.
- Ask for 2 student volunteers to join outstretched hands.
- Measure the length of their conjoined span.
- Record the number of students (2) and their conjoined length as an ordered pair.
- Continue this process for 3, 4, 6, 7, 9, 10, 12, and 14 student volunteer groups.

Lines of Best Fit:

- Make a scatter plot of the data points without the calculator.
- Draw a line on your graph that you think best represents the data.
- Determine the median-median line without use of the calculator.
- Use the graphing calculator to draw the least squares line.

Predictions:

- Compare and contrast the median-median line and the least squares line.
- Make predictions about the number of students needed to make a ring around the classroom.
- Make other predictions about number of students and distances covered, using the least-squares equation.

Performance Assessment:

The teacher will observe student construction of scatter plots and median-median line. Through appropriate questions the teacher will check understanding of the regression lines as a means of prediction. See the Teacher Checklist for Understanding at the end of the unit.

Extension/Follow Up:

- Using the derived regression equation, determine the length to be made by the number of students in your school.
- Using the derived regression equation, predict the distance covered by those in attendance at a football game.
- Using the same data, construct a histogram.
- Investigate other best fit curves such as quadratic, exponential and power.

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Activity Sheet 1: **Reach Out and Touch**

Name_____ Date _____ Period _____

Directions:

1. In Table 1, write the number of students in the x-column and their total arm-span length in the y-column.

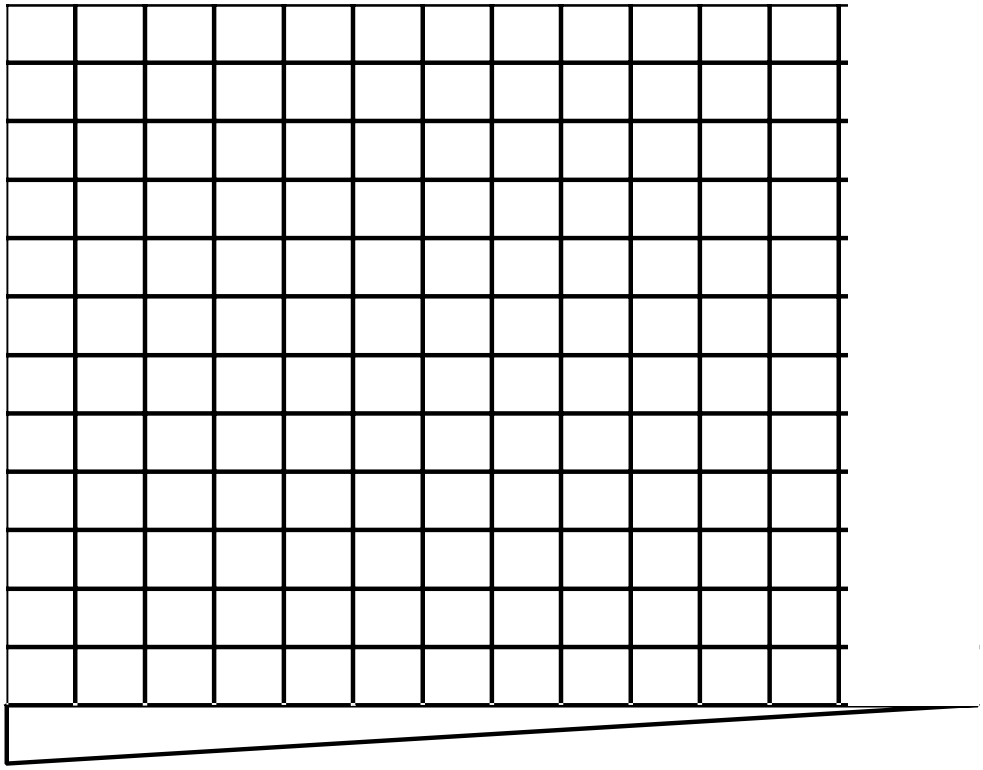
2. Construct a scatter plot using Table 1 data and appropriate scales for the axes.

3. Using a ruler draw a line you think best represents the data (Label #1).

Table 1

X	Y

Scatter Plot



4. Determine the median-median line using the following instructions.

   a. Partition points into 3 equal groups.

   b. Find the representative point (median of x-values, median of y-values) of each group.

      _____ _____ _____

   c. Find the slope-intercept equation of the line through the left and right representative points.

      _____

   d. Find the distance of the middle representative point from the equation in part (c).

      _____

   e. Add one-third of this distance to the y-intercept of the equation of part (c) to obtain the median-median line.

      _____

   f. Graph the median-median line on your scatter plot (Label #2).

Activity Sheet 2: **The Best Fit**

Name _____ Date _____ Period _____

Directions:

1. Using the STAT key on the graphics calculator, input the number of students for each trial (x-values) in L_1 and their conjoined distances (y-values) in L_2.

2. Press STAT, arrow to CALC for linear regression. Press 2nd (L_1), 2nd (L_2), VARS, Y-VARS, Y_1 ENTER. This will paste the least squares linear equation into the GRAPH key.

3. Press ZOOM 9 to view the least squares line.

4. Use TRACE to approximate the y-intercept of this line.
   _____

5. Press Y= and record the equation.
   _____

6. Draw this least squares line on your scatter plot (Label #3).

Predictions:

1. Write a description of the median-median line (#2) and the least squares line (#3) including their similarities and differences.

_____

_____

_____

_____

2. Tell which line you think best fits the data and justify your choice.

_____

_____

_____

3. Using your chosen equation, predict the number of students (x-value) needed to make a ring around the classroom.

_____

4. Using your chosen equation, predict the number of students (x-value) needed to cover the perimeter of your school football field.

_____

5. Using your chosen equation, predict the number of students (x-value) needed to reach a distance of one mile.

_____

Teacher Checklist for Understanding

	Yes	No
1. Can the student accurately plot points on the coordinate plane?		
2. Is the student able to substitute for the correct variable?		
3. Can the student predict other values within the range of the independent variable?		
4. Given additional problems, is the student able to identify the independent and dependent variable?		
5. Can the student use the calculator to write a best-fit equation?		